TEXTURED IN-MOLD LABEL

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of International Patent Application PCT/US03/04693, filed February 14, 1993 and designating the United States. It is related to the inventions disclosed and claimed in commonly assigned pending unpublished applications 09/566,363 filed May 5, 2000 and 10/349,563 filed January 22, 2003, both of which claim priority from provisional application 60/182,490 filed February 15, 2000.

TECHNICAL FIELD

The technology described below includes systems and methods for producing sleeve-like textured or roughened objects, or "textured sleeves," and also the textured sleeves themselves. Textured sleeves are particularly useful in the manufacture of containers displaying images, as standalone containers bearing an image, and as standalone objects which may be added at any point to another object (for example, the point of sale to an end user).

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings are schematic, and therefore may not exactly match the appearance of a commercial embodiment of the technology described by the text and claims below.

Figure 1 is a schematic diagram of an embodiment of a textured or roughened blank according to the invention.

Figure 2 is a cross-section taken along the line 2-2 of Figure 1.

Figure 3 is a partial side view of the textured or roughened blank of Figures 1 and 2 during a preferred process of forming a textured or roughened sleeve.

Figure 4 is a schematic diagram of another embodiment of a textured or roughened blank according to the invention.

Figure 5 is a cross-section taken along the line 5-5 of Figure 4.

Figure 6 is a perspective view of the textured or roughened sleeve formed from the textured or roughened blank of Figures 1 and 2 according to the process of Figure 3.

Figure 7 is a cross-section of another embodiment of the invention.

DETAILED DESCRIPTION

In addition to the description below, the following are incorporated in their entireties as part of this disclosure: US Patents 2,942,530; 5,525,383; 5,752,907; 6,158,612; 6,182,855; and 6,490,063; Published US Patent Application US 2002/0114080; and the following International Applications Published under the Patent Cooperation Treaty: WO 01/96079A2 and 02/051611A1. The invention concerns textured or roughened sleeves, formed from preferred materials and/or in a preferred process, that are suitable for uses disclosed in one or more of these documents, as well as the commonly owned related applications noted above.

For convenience only, this description will on occasion refer to a cup or similar single-ended volume container, but other containers within the full scope of the invention include (but are not limited to) bottles and other similar packages for other materials.

One of ordinary skill in this art will appreciate that the textured or roughened materials described here may also serve as standalone containers, *e.g.*, cups, bottles, other containers, and packages in general. This may require suitable modifications to this disclosure that are within their skill. Similarly, textured or

roughened materials created according to the principles of the invention may also serve as separate objects that are intended to be added to other objects.

Figure 1 is a front view of a textured or roughened blank **10** having opposed sides **11** and **12** that are illustrated as arbitrarily curved but are preferred to be straight as indicated by dashed lines **11a** and **12a**. Any shape that permits mating sides to fit together to form a closed surface sleeve with a continuous seam, as will be discussed below, is within the scope of the invention. For example, sinusoidal and zig-zag seams are possible. It is preferred but not required that the sides mate with each other as illustrated, however, especially in the case of overlapping seams formed as described below, it may be advantageous for each side to have a different shape, and all such shapes are considered to be within the scope of the invention.

Figure 2 is a cross section of blank **10**, illustrating various layers that are preferably formed into an integral laminate according to known principles of printing, laminating, and other similar forms of assembly. Textured or roughened blank **10** comprises an ordered or random set or collection of features **21** on its outer (in the Figure, its upper) or front face; the size and number of features **21** may or may not be coordinated with the images that form image layer **30**. Generally circular cross-sectional features are illustrated and preferred, but other shapes are within the scope of the invention. As is well known, printing or otherwise forming an image layer **30** onto the inner (lower) or back face of blank **10** permits the viewer, who is viewing from the upper side of the figure (*i.e.*, they are viewing the outer or front face), to perceive images by viewing image layer **30** through features **21** and/or the remainder of textured or roughened material **20**. As is well known in the art and applicable for this entire disclosure, the images perceived in this manner may be any known types of images.

One or more optional layers may be included in the integral laminate **10**. For example, optional backing layer **40** and optional protection layer **50** may be added to the integral construction of blank **10** depending on the end use

application, as described below. If used, the outer side of backing layer **40** is immediately adjacent (if not in actual contact with) the inner side of image layer **30**; similarly, the outer side of protection layer **50** is immediately adjacent (if not in actual contact with) the inner side of backing layer **40**. A substrate material (not shown), such as the injection molded plastic to be described below, may be immediately adjacent (if not in actual contact with) the inner side of the lowest layer of the laminate, whichever type of layer that may be.

Figure 3 illustrates the formation of a closed-surface sleeve from blank **10** by use of a known (but for the modifications described here) machine commonly used to manufacture paper cups. In this process, blank **10** is placed on mandrel **100** and ends **11** and **12** are brought together, all in a conventional manner. Seam **13** is formed between ends **11** and **12** by bonding applicator **110**. The bonding applicator can employ any one or more of heat, pressure, applied or activated adhesive, or other similar known means for joining the particular materials employed. Also, as is known in the art of such machinery, supplemental heat can be applied if desired, from either below or above blank **10** as it is wound around mandrel **100**. This ensures that the region in the vicinity of end **11** or **12** (or both) is sufficiently heated or otherwise prepared for formation of seam **13**.

Details of the wrapping process and equipment are well known in the art. Examples include US Patents 2,942,530 (for generally cylindrical or conical containers); 4,349,345 (for non-cylindrical containers); 4,490,130 (heating of the blank); 5,569,143; and 5,752,907 (mechanical release of the formed sleeve from the mandrel). The entire contents of each of these documents is incorporated by reference.

While Figure 3 illustrates the preferred embodiment in which ends **11** and **12** are brought together without overlap (and thus without increasing the net cross-sectional thickness of blank **10**) in the vicinity of seam **13**. This is for illustrative purposes only, as the invention includes embodiments in which such overlap is formed. For example, the invention includes embodiments in which ends **11** and

12 are cut at an angle, *i.e.*, skived, as indicated in the alternative embodiment illustrated by the dashed lines in the magnified portion of the figure. The exact value of the skive angle is not critical to the invention.

Also, as is well understood in the art, a minor amount of overlap may be required or desirable depending on the materials, techniques for joining ends **11** and **12** employed, intended end use, and other factors. Thus, in another example, Figures 4 and 5 illustrate an alternative embodiment with an overlapping seam **13**. It may be desirable to for either or both of ends **11** and **12** to be angled or skived in this embodiment also, so that the outermost surface is smoother than illustrated in these schematic figures.

Therefore, it should be understood that discussion of ends **11** and **12** refers not just to the most extreme locations forming the opposite sides of blank **10** when lying flat, but also, if context so dictates or permits, to the general regions of the opposed portions of blank **10** which become the region in which seam **13** is formed.

Figure 6 is a perspective view of a closed-surface textured or roughened sleeve **200** formed in the process illustrated by Figure 3 and afterward removed from mandrel **100**. In the preferred embodiment of Figure 1, in which blank **10** has upper and lower curved surfaces **14** and **15**, the closed-surface sleeve **200** is a portion, or frustrum, of a hollow tapered sleeve or hollow inverted cone. Textured or roughened layer **20** faces outward, *i.e.*, the image (as schematically illustrated, a three-dimensional letter "A") appears on the outer surface of sleeve **200**.

The sleeve of Figure 6 may also be characterized as self-supporting or free-standing. That is, because seam **13** integrally joins ends **11** and **12** and therefore prevents sleeve **200** from unfurling to resume its flat shape after being removed from the manufacturing equipment, sleeve **200** can be said to be self-supporting in the shape it ultimately assumes (*e.g.*, a frustrum of a cone, a cylinder, and so on). In the particular shape illustrated in Figure 6, the circular cross-sectional shape of

sleeve **200** ensures that the upper and lower ends **16** and **17**, respectively, are closed plane figures (in this specific case, circles) as opposed to merely linear edges in the case of upper and lower edges **14** and **15**, respectively. In the most general case, creation of a sleeve, creates sufficient locations on at least one end of the sleeve to allow the sleeve to be free-standing on a suitable surface. Either of these characteristics, the self-supporting nature, or the free-standing nature, distinguish these embodiments of the invention from other blanks that have been previously employed to incorporate images into containers and similar objects.

Sleeves formed according to the general process described above may be products for use in at least four major applications: (1) As textured or roughened inserts for injection molded cups; (2) As textured or roughened tapered sleeves to be attached to existing paper or plastic cups; (3) as a tapered sleeve that may be glued onto existing paper or plastic cups or containers; or (4) as a component of cups made using modified existing paper cup technology, *i.e.*, by adding a bottom to either of the open ends of the sleeve illustrated in Figure 6 (typically but not necessarily the smaller diameter end). Each of these is described in the following examples, which are illustrative only. The scope of possible uses of the invention is not limited by these examples.

Example One

A tapered textured or roughened sleeve that can be used as an insert in the injection molding of cups is constructed generally as described above.

A suitable textured or roughened sheet has a thickness between 0.005 and 0.025 inch (0.0127 mm and 0.0635 mm), measured from the typically flat back side of the material (*i.e.*, the lower side as illustrated in Figure 2) to the maximum height of any lenticules on the front side of the material (the upper side in Figure 2). Other known textured or roughened materials are also suitable.

Suitable compounds for the material include amorphous polyester terephthalate (APET), glycol-modified polyethylene terephthalate (PETG),

polyvinylchloride (PVC), polycarbonate, polypropylene, and other materials known to have similar optical and materials properties for this application. The finish of the material is gloss on the front, or outer, side having the textured or roughened features, and may be either gloss or matte on the back, or inner, side on which the image is formed.

An image, comprising one or more sets of images if desired, is formed on the back side of the textured or roughened sheet. The preferred image formation process uses inks that are curable with ultraviolet (UV) light, but other, conventional inks may be used.

An optional backing material is preferably laminated over the image. It has a thickness between 0.0055 and 0.005 inch (0.14 and 0.13 millimeters, respectively). Suitable compounds for the backing material include polyethylene and polypropylene, other materials known to have similar materials properties for this application may be used.

This insert may be used to manufacture an integral injection molded cup as more specifically described in one or more of: the commonly owned applications cited above; US Patent 6,490,063; Published US Patent Application US 2002/0114080; and the following International Applications Published under the Patent Cooperation Treaty: WO 01/96079A2 and 02/051611A1. As specified in those documents, typical substrates (*i.e.*, the injected molded plastic into which the textured or roughened insert is integrally formed) include plastics such as polyethylene, polypropylene, PVC or a blend using one of these plastics with other materials.

Specifically, the sleeves of this invention may be used to manufacture cups as described in the documents noted above by being components of the following processes:

(1) Providing a material sheet comprising a textured or roughened layer having a first and a second surface and an ink layer bonded to the

second surface of the textured or roughened layer; bonding a substrate to the ink layer; cutting a piece from the material sheet; forming a insert in the configuration of a sleeve; positioning the insert in a mold cavity of a plastic molding assembly; operating the plastic molding assembly to process a plastic material charge into the mold cavity at a predetermined molding temperature and to form the plastic object; and cooling and ejecting the plastic product from the mold cavity; in which at least a portion of the substrate bonds to the plastic material charge during the operating of the plastic molding assembly and in which the substrate is adapted for thermally isolating the ink layer during the operating of the plastic molding assembly.

(2) Providing a thin textured or roughened insert in the form of a closed-surface sleeve comprising a layer having a first and a second surface and an ink layer bonded to the second (not textured or roughened) surface of the layer; providing a mold cavity of a plastic molding assembly configured to define the dimensions of the plastic product; positioning the insert in the mold cavity with the first surface adjacent a wall of the mold cavity; operating the plastic molding assembly to at least partially fill the mold cavity with liquid plastic, in which the mold cavity and insert being configured such that a frame member is formed along each exposed edge of the insert; cooling the mold cavity; and ejecting the hardened plastic product with the insert retained in position by the frame members.

It should be noted that this process is less preferred to the extent that a frame member is formed, because the design of the sleeve of the invention generally makes frame members unnecessary.

(3) Providing a closed-surface insert comprising a textured or roughened layer having a first and a second surface, an ink layer

bonded to the second (not textured or roughened) surface of the lens layer, and a substrate bonded to the ink layer; positioning the insert in a mold cavity of a plastic molding assembly; and operating the plastic molding assembly to process a plastic material charge into the mold cavity at a predetermined molding temperature and to form the plastic object; in which at least a portion of the substrate bonds to the plastic material charge during the operating of the plastic molding assembly and in which the substrate is adapted for thermally isolating the ink layer during the operating of the plastic molding assembly.

(4) Providing a thin textured or roughened insert in the form of a closed-surface sleeve comprising a textured or roughened layer having a first and a second surface and an ink layer bonded to the second surface of the textured or roughened layer; providing a mold cavity of a plastic molding assembly configured to define the dimensions of the plastic product; positioning the insert in the mold cavity with the first surface adjacent a wall of the mold cavity; operating the plastic molding assembly to at least partially fill the mold cavity with liquid plastic, in which the mold cavity and insert being configured such that a frame member is formed along each exposed edge of the insert, the insert being retained in position by the frame members.

Again, this process is less preferred to the extent that a frame member is formed, because the design of the sleeve of the invention generally makes frame members unnecessary.

To manufacture textured or roughened sleeve of this example, the first step is to print the smooth lower side of the extruded textured or roughened lens material. The sheet size can range in size from ten by fourteen inches (25.4 by 35.6 centimeter) to twenty-eight by forty inches (71.1 by 101.6 centimeter), depending

on the images, colors, and other aspects of the image desired. Depending on sheet size, and the tapered cup blank size desired, the locations of multiple blanks can be arranged together in the plane of the sheet and therefore printed on a single sheet at the same time. The inks may be 4-color process or any combination of desired colors commercially available, inks can either be conventional or UV cured. The printing method could be, but is not limited to, a lithographic press configured with UV Lamps to cure the ink. Web printing is also suitable.

The optional backing layer may be used for one of more of the following purposes: to add thickness; to add opacity; to provide a cushion so the ink of the image layer is not distorted from the temperature or pressure imposed by the injected plastic; or to serve as a bonding layer to promote greater adhesion to the plastic used in the injection molding process. There are many suitable methods for adding the optional backing layer, including: thermal lamination; use of a coating machine such of the well-known Billhoffer type; extrusion coating; coating a laminate material; and printing a coating material in place. If web printing is used, the lamination can be performed inline.

The next steps are to cut (*e.g.*, diecut, male-female punch, or any other suitable technique) the tapered cup blanks from the textured or roughened sheets, followed by conversion of the tapered cup blanks into tapered sleeves on modified paper cup making equipment. If web printing is used, inline rotary diecutting is acceptable.

Suitable paper cup equipment includes the model PMC OW800 overwrapping machine manufactured by Paper Machinery Corporation (Milwaukee, USA). Other suitable machines include the PMC 1002 cup forming machine manufactured by the same company. In general, the machine takes blanks, starts them around a mandrel, then transfers the assembly to another station which blows hot air on the two sealed surfaces (one from top and one from bottom) at approximately 700 Celsius (1300 degrees Fahrenheit). The machine then folds the blanks around the mandrel and a pressure foot comes down and holds the two ends

against each other for a very short time until the two surfaces are bonded to each other. This type of machine can be modified to use other methods of bonding such as adhesive or chemical bonding if desired.

Finally, an optional step is to nest and stack finished sleeves for bulk packaging or transport to the injection molding apparatus, at which the tapered sleeves are then inserted into injection molds. Suitable equipment for this purpose is disclosed in US Patent 6,267,550, the entire contents of which are incorporated by reference.

In one embodiment, due to the taper of the sleeve and the taper of the die in the injection molding apparatus, the sleeve will only enter the die until the outer surface of the tapered sleeve equals the inner tapered surface of the female portion of the die. In some embodiments, various means for holding the sleeve in place may be used, such as the known pin system, friction, vacuum or electrostatic forces. All of these hold the sleeve against the inner diameter of the mold so that the molded cup may be formed properly to the inside of the inner side of the sleeve. In any case, the molten injection-molded plastic will tend to additionally hold the sleeve in place as it flows to form the cup. In one embodiment, the molten plastic also forms a lip below and above the sleeve to prevent the sleeve from sliding down the taper of the cup.

In this embodiment, it is preferred that the ink layer be backed by an opaque layer to enhance the optical properties of the image layer, and further that the backing layer be a bonding layer to enhance the bond between the sleeve and the injection molded plastic despite the heat generated from the plastic; the backing layer also provides a cushion to help prevent distortion of the ink layer, which could adversely affect the image created by the ink layer and textured or roughened material.

Example Two

A tapered sleeve that can be attached to existing paper or plastic cups is constructed generally as described in Example One. Once the tapered cup blanks have been cut or punched from the textured or roughened sheets, they are converted into tapered sleeves on the modified paper cup making equipment; again, the model PMC OW800 overwrapping machine manufactured by Paper Machinery Corporation (Milwaukee, USA) is suitable as described above. Other suitable machines include the PMC 1002 cup forming machine manufactured by the same company. Heat and pressure are satisfactory but adhesives or chemical bonding techniques can also be used. The sleeves may be nested and stacked for packaging, if desired.

Variations on this embodiment include: (1) omission of optional backing layer **40**; and (2) use of a thermal insulation layer as optional protection layer **50** so that the sleeve is suitable for non-insulated containers holding hot or cold contents, such as a paper cup holding hot coffee.

Sleeves formed in this manner may be slid onto existing paper or plastic cups. It is possible for tapered plastic injection molded cups to be manufactured with features that provide a built in locking mechanism, such that when the sleeve is slid over the locking mechanism, the mechanism engages and holds the sleeve from sliding back down the taper. Alternatively, the sleeve could be printed with a tacky non-skid coating to adhere the sleeve to the existing cup surface.

It is possible to design a mechanical feature, such as a lip, into any object that such a sleeve slides upon, to hold the sleeve in position on the object. Such a feature could be incorporated into the mold of either an injection molding or a blow molding process, or as known in the art for other processes of forming containers or objects.

Example Three

The textured or roughened blanks of Example Two may be formed as described above, but instead of being formed into free-standing sleeves, they may be attached to pre-existing paper or plastic cups or containers. The preferred attachment technique is the use of any form of suitable adhesive, either a separately applied material or a layer or coating of adhesive added to the integral laminate.

The model OW800 wrapping machine manufactured by Paper Machine Corporation is suitable. Other suitable machines include the PMC 1002 cup forming machine manufactured by the same company. The machine takes the blanks and applies adhesive to at least one edge, then places a cup or container onto a mandrel. The blanks are affixed around the cup or container, preferably by using clamps to hold the sleeve against the cup or container for the period of time required for the overlapping sleeve to be bonded to the cup (*e.g.*, by activating the layer or coating of adhesive). One preferred type of adhesive is a hot melt moisture cure urethane, although the exact selection would depend on various parameters such as throughput desired, temperature required for activation, and so on.

The adhesive bonds the laminate to the surface of the cup or container at least along vicinity of the seam edge. In other embodiments, the equipment could be modified to bond the wrap to the entire surface of the cup or container, or any variation of glue pattern created on the blank.

As before, it is desirable to nest and stack the finished cups or containers for subsequent packaging, but this is not critical to the scope of the invention.

Example Four

A tapered textured or roughened cup may be manufactured as generally described above, but as illustrated in Figure 7, a different construction is employed in the integral laminate that forms the textured or roughened blank. Specifically, textured or roughened blank **210** comprises six layers. Proceeding from the outer

(in the Figure, the upper) side to the inner (lower) side, they are embossing layer **220**, in which features **221** are formed as described below; clear core layer **260**; outer bonding layer **255**; ink layer **230**; paper core layer **270**; and inner bonding layer **250**. The entire textured or roughened blank **210** has thickness between 0.015 inches and 0.020 inches (0.38 and 0.51 millimeters). Preferred materials and other parameters for each layer follow.

Embossing layer

Polypropylene or polyethylene; approximate thickness 0.005 to 0.009 inches (0.13 to 0.23 millimeters)

Clear Core

Polyethylene or polypropylene; approximate thickness 0.005 to 0.009 inches (0.13 to 0.23 millimeters)

Outer Bonding Layer

Polyethylene or polypropylene; approximate thickness 0.0025 to 0.001 inches (0.0064 to 0.025 millimeters)

Ink

UV or conventional

Paper Core

White paper board, approximately 0.009 inches (0.229 millimeters) in thickness. Other materials may be substituted for paper board in accordance with known principles, thus the term "paper" should be appreciated as a term of identification and not of composition.

Inner Bonding Layer

Polyethylene or polypropylene; approximate thickness 0.0025 to 0.001 inches (0.064 to 0.025 millimeters)

To manufacture this embodiment, the first step is to print one side of the paperboard layer. The textured or roughened sheet size can range in size from ten by fourteen inches (25.4 by 35.6 centimeter) to twenty-eight by forty inches (71.1 by 101.6 centimeter), depending on the images, colors, and other aspects of the image desired. If web production is used, the roll of material has a width determined by the web handling equipment employed and other considerations within the skill of the art.

Depending on sheet size, and the tapered cup blank size desired, the locations of multiple blanks can be nested together in the plane of the textured or roughened sheet and therefore printed on a single sheet at the same time. The inks may be 4-color process or any combination of desired colors commercially available, inks can either be conventional or UV cured. The printing method could be, but is not limited to, a lithographic press configured with UV Lamps to cure the ink.

Next, an extrusion coating of polyethylene or polypropylene is applied to the outer and inner sides of the paper sheets. Either clear polypropylene or polyethylene is then applied to form the clear core layer. Suitable techniques include cold, thermal, or belt laminating. The embossing layer is next applied. by extrusion coating, cold laminating or thermal laminating. The final step to form the laminate is to emboss the textured or roughened surface into the embossing layer to form the textured or roughened pattern of features. In the preferred embodiment, this step can be performed in-line while applying the embossing layer. In some cases, care must be taken to register the textured or roughened pattern parallel with the image printed on the paperboard, but this is within the skill of the art. As with

the other examples, the blanks are removed from the sheet by diecutting, male-female punch, and the like.

To convert the tapered cup blanks into cups, modified or existing paper cup making equipment as described above may be used. Again, a suitable apparatus is the model OW800 manufactured by Paper Machine Corporation. Other suitable machines include the PMC 1002 cup forming machine manufactured by the same company. The machine takes blanks, and pre made paper bottom pieces, and makes cups in the same fashion conventional paper cups are made. Further details are contained in US Patents 5,569,143 and 5,624,367, the entire contents of which are incorporated by reference. The optional step of nesting and stacking the finished cups for packaging, as described above, is preferred but not required by the invention.

Example Five

Traditionally in-mold decoration in injection molding has either been done by printing a film and inserting into the mold as described in patent number 6,544,634 (the entire disclosure of which is incorporated by reference), or as described above. An in-mold decorated article that has a desired textured or roughened surface (for example, that like a football or basketball) and custom graphics behind the texture may be crated using generally the same processes as described above. The article could either be a cup, DVD or other media case, a lunch box, a food or consumer package, or any other type of injection blow molded or impact molded product.

In general terms, such articles are constructed by the following process. First, engraving an extrusion or calendaring embossing cylinder with the reverse of the desired textured or roughened pattern. Next, extruding a clear plastic material with the desired textured or roughened pattern on one side, designated side "A" (*i.e.*, the side embossed with the cylinder), and a smooth or matte finish on the other side (side "B"). Next, printing side "B" with a reversed image so that the

proper image appears through the textured or roughened features when the product is viewed through side "A." Then, if necessary, one may apply a substrate, either a film or (possibly but not necessarily an adhesive) coating, or an ink, chosen for compatibility with molten plastic expected in the intended mold, either an injection mold, a blow mold, or an impact mold.

The particular part is cut from the material in the desired size. It may be preferable to die cut the part in such a way as to "deaden" or otherwise modify the texture at the edges of the part. The part is inserted with the textured or roughened pattern pointing to the outside of the mold and the substrate pointing toward the inside of the mold where the plastic will be shot. Conventional shooting of the plastic charge into the mold, and conventional ejection of the part with the textured label as an integral part of the product, then follow.

In the above description and the claims, "closed-surface" means that two opposed edges of the textured or roughened material or blank have been brought together and joined to each other by an edge-to-edge or "butt" joint, an angle or skived joint, an overlapping joint, a lap seam, and so on. This forms a hollow sleeve of material prior to any attachment of the sleeve to another object. The edge-to-edge seam may be any pattern, including straight, sinusoidal, zig-zag, and so on. "Electric potential" includes both electrostatic charge and dynamically controlled electromagnetic forces. "Integral" refers to a condition in which (intended or unintended) removal or disassembly would significantly impair the function of an assembly or laminate, or significantly reduce the commercial or technical quality of the same when the intended purpose of the product is considered.

It should be understood that laminates said to comprise, *i.e.*, to include but not be limited to, specific layers can also have additional layers not specified disclosed here if they do not affect the scope of the invention. For example, it is known in the art to use auxiliary opaque ink layers on the back (non-viewed) side of an image layer to enhance the optical performance of the ink used to create the image layer. The invention and the specific examples and disclosure above should

be understood as specifying layers that not only are in direct contact with each other, but that also are separated from each other yet functionally adjacent in the sense that the invention nonetheless operates according to the principles disclosed above as they are understood in the art. In the regard, the terms "inner" and "outer" and those of similar import used to describe surfaces or locations of layers should be understood to specify relative locations as appropriate.

Unless specifically identified above as a critical measurement, all numerical values above should be understood to be approximate values that could lie within a range of manufacturing and/or measurement tolerance that does not affect the performance or function of the invention as defined by the claims.

It should be understood that references to any textured or roughened material or sheet include pre-supplied materials and sheets as well as those manufactured from non textured or roughened materials by any suitable process of texturing or roughening. For example, textured or roughened materials may be produced by engraving an extrusion or calendaring embossing cylinder, followed by extruding a clear plastic with the desired textured or roughened pattern on side "A" (embossed with the cylinder) and a smooth or matte finish on side "B" (the non textured or roughened side).